Randomized Control Trial

Ultrasound-guided Erector Spinae Muscle Block Versus Ultrasound-guided Caudal Block in Pediatric Patients Undergoing Lower Abdominal Surgeries

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Background: The erector spinae plane block is a new regional anesthetic technique that is gaining popularity in pediatric medicine.

Objectives: This study aimed to evaluate the safety and efficacy of ultrasound-guided erector spinae block and compare its analgesic effect with that of the ultrasound-guided caudal block in pediatric patients.

Study Design: Prospective, randomized, double-blind, controlled study.

Setting: Department of Anesthesia and Intensive Care, faculty of medicine, Minia University, Egypt.

Methods: Sixty-three children scheduled for unilateral lower abdominal surgeries, under general anesthesia were randomly allocated into 3 parallel equal groups: Group I (erector spinae block [ESB] group) received ultrasound-guided an erector spinae muscle block in a dose of 0.4 mg/kg of 0.25% bupivacaine between the 10th transverse process and the erector spinae muscles. Group II (caudal block [CB] group) received an ultrasound-guided caudal block in a dose of 2.5 mg/kg of 0.25% bupivacaine. The last group, Group III (control [C] group), did not receive any regional block. Our primary outcome was to evaluate the quality of postoperative analgesia using the Face, Legs, Activity, Cry, Consolability (FLACC) Pain Scale; secondary outcomes were to assess the time to first analgesic request, total analgesic requests during the first 24 hours, and the occurrence of any side effects.

Results: The early postoperative FLACC score was less in the ESB group than the CB group; both were lower than the control group. The erector spinae block had a longer duration of analgesia than the caudal block as the median (interquartile range [IQR]) ``of the duration of analgesia in the ESB group was 8 (8-12) hours while it was 6 (6-8) hours in group the CB group; both groups had a longer duration of analgesia compared to the C group 0.25 (0.17-4) hours. The total amount of analgesia was less in the ESB group than the CB group. The number of patients who needed rescue intravenous fentanyl analgesia was 14 patients in the C group while no patient needed intravenous fentanyl in the ESB and CB groups.

Limitations: Sensory evaluation of the patients was not done since the 2 blocks were done under general anesthesia but did not affect the outcome.

Conclusions: Ultrasound-guided erector spinae block was safe and effective in pediatric patients undergoing unilateral lower abdominal surgery as it provided a longer duration of analgesia and less analgesic requirement than caudal block and fewer side effects.

Key words: Ultrasound-guided, erector spinae, caudal, abdominal surgeries, analgesia, side effects, FLACC score, duration of analgesia

IRB number: 266: 2019

Clinical trial registration number: clinical trial.gov (NCT04690894).

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Regional anesthetic techniques have been promoted for pain management in pediatric surgery, as they minimize parenteral opioid requirements and increase the efficiency of postoperative pain control as well as patient-parent satisfaction (1).

Erector spinae block was first described by Forero et al in 2016 (2). It is an effective regional anesthesia method witnessed to have characteristics of postoperative analgesia in numerous thoracic and abdominal operations because it blocks both somatic and visceral pain. As a result of injecting a local anesthetic into the interfascial space between the transverse process and the erector spinae muscle, it is performed by distributing local anesthetic into several paravertebral spaces (3).

Caudal block is remarkable because of its simplicity, safety, and effectiveness. A single shot caudal block with a local anesthetic agent, such as bupivacaine, is a standard procedure, and analgesia is provided during surgery; unfortunately, its action stops early in the postoperative period (4).

This study aimed to evaluate the safety and efficacy of ultrasound-guided erector spinae block and compare its analgesic effect with the analgesic effect of ultrasound-guided caudal block in pediatric patients undergoing unilateral lower abdominal surgery under general anesthesia. Our primary outcome was to evaluate the quality of postoperative analgesia using the Face, Legs, Activity, Cry, Consolability (FLACC) Pain Scale. Our secondary outcomes were to assess the time to the first analgesic request, the total analgesic requests during the first 24 hours, and the occurrence of any side effects.

Methods

After obtaining Institutional Ethical Committee approval number 266: 2019 and written informed consent from parents of the patients, this prospective, randomized double-blind controlled study was conducted on 63 pediatric patients of both genders with the following inclusion criteria: American Society of Anesthesiology Patient Classification Status I and II, weight 10-25 kg,) aged 2-6 years, scheduled for unilateral lower abdominal surgery under general anesthesia at Minia University Hospital in the period from February 2019 through January 2020. The trial was registered before patient enrollment at clinical trial.gov (NCT04690894).

Exclusion Criteria

Children who had spinal anomalies, altered mental status, a history of developmental delay, blood diseases, infection at the site of injection, drug allergy, bilateral surgery or additional surgical procedures at different surgical sites, and parents refusing to participate were excluded from the trial.

Preoperative Assessment

Careful history taking was done from the parents of the child for any medical disorder such as congenital coagulation disorders or therapeutic anticoagulant. A complete physical examination of the child was done including the central nervous system for signs of mental disturbance, the chest for any deformities or chest infection, the heart for congenital heart disease, and the back for any spinal deformities or infection at the site of injection. Routine investigations were done for the child including a complete blood count and coagulation profile.

Anesthetic Management

On arrival of the patient to the operative theater, and after placement of standard monitoring (including electrocardiogram, noninvasive blood pressure, pulse oximetry, and temperature probe), general inhalational anesthesia was induced by face mask with sevoflurane (4-8%) in 80% oxygen. After an intravenous (IV) cannula was secured, patients aged 2-4 years received one µg/kg fentanyl; intubation was facilitated by 0.5 mg/kg atracurium. Patients aged 4-6 years received fentanyl 1-2 µg/kg, propofol 1-2 mg/kg; intubation was facilitated by 0.5 mg/kg atracurium. Isoflurane 1%-2% with oxygen was used for anesthetic maintenance.

Randomization and Blinding

The patients were randomly allocated into one of 3 parallel equal groups (21 patients in each group) according to sample size.

Randomization was done using a computer-generated random numbering of each study patient. Opaque sealed envelopes were used and opened in the operative theater by an investigator who was blind to the study. Both the patient and the investigator who collected the data after the block were blind to the study group.

In Group I (erector spinae block [ESB] group) the patient received an ultrasound-guided erector spinae muscle block in a dose of 0.4 mg/kg of 0.25% bupivacaine between the 10th transverse process and erector spinae muscles. In Group II (caudal block [CB] group) the patient received an ultrasound-guided caudal block

in a dose of 2.5 mg/kg of bupivacaine (0.25%).In Group III (control [C] group) the patient did not receive any regional block.

Block Technique

After stabilizing the patient's hemodynamics and before skin incision, an erector spinae muscle block or caudal block was performed with the patient in the lateral decubitus position.

In the ESB group, the patient was placed in the lateral position. The site of surgery was upward. Following skin preparation using 10% povidone-iodine, a high-frequency linear ultrasound transducer was placed over the ipsilateral site of surgery 1–2 cm lateral to the spine at the T10 level, counting upward from the sacrum. After identifying the erector spinae muscles and transverse process, a needle was inserted with an in-plane technique in the craniocaudal direction. After negative aspiration, a total of 0.4 mg/kg of 0.25% bupivacaine was administered between the 10th transverse process and erector spinae muscles using a 22G needle.

In the CB group, patients were placed in a lateral position. An ultrasound transducer was first placed transversely at the midline to obtain a transverse view of the 2 cornua, the sacrococcygeal ligament, sacral bone, and sacral hiatus. At this position, the ultrasound transducer was twisted to 90° to obtain longitudinal views of the sacrococcygeal ligament and sacral hiatus and was subsequently placed between the 2 cornua and on visualization of the frog sign (the 2 sacral cornua identified as 2 hyperechoic reverse U-shaped structure) the needle was inserted into the sacral canal under direct real-time longitudinal visualization. After negative aspiration for blood or cerebrospinal fluid, bupivacaine (0.25%) 2.5 mg/kg was injected over a one minute period while observing an ultrasound longitudinal image.

After the block, patients were flipped back to their normal supine position, the surgery took place 10 minutes after injection of local anesthetic, and hemodynamics were continuously monitored including noninvasive blood pressure, heart rate, temperature, and O_2 saturation. If there was any increase in hemodynamics more than 20% of baseline values, an additional dose of intravenous fentanyl 0.5 µg/kg was administered. The total intraoperative fentanyl requirement was noted.

After termination of surgery, reversal of the atracurium was done by giving neostigmine in a dose of 0.04 mg/kg and atropine in a dose of 0.02 mg/kg then awake extubation of the patients was done. The patients were transferred to the recovery room, then discharged to the ward when their modified Aldrete score was ≥ 11. They were carefully monitored postoperatively for hemodynamics including noninvasive blood pressure, heart rate, temperature, O2 saturation, and FLACC score (5) (Table 1). If the FLACC score was ≥ 3, analgesia in the form of a diclofenac sodium suppository was administrated in a dose of 1 mg/kg. If this analgesia was not adequate, intravenous fentanyl at 1 µg/kg was given and the total analgesic requirements of diclofenac and fentanyl were recorded.

Study Outcomes

Primary Outcome

The primary outcome was to evaluate the quality of postoperative analgesia during the early postoperative hours using the FLACC score.

Secondary Outcomes

Secondary outcomes included the amount of intraoperative analgesia, the time to first analgesic request, total analgesic requests during first 24 hours, and the incidence of side effects.

Table 1. *FLACC Scale.*

Categories	Score		
	0	1	2
Face	No expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort.

Data Collection

Intraoperative Period

The total intraoperative IV fentanyl requirements in µg, anesthesia time in minutes (from induction of anesthesia until awake extubation), and surgical time in minutes (from skin incision until skin closure) were recorded intraoperatively.

Postoperative Period

Postoperatively we measured the following: FLACC pain score after recovery, then at one, 2, 3, 4, 6, 8, 12, 16, 20 and 24 hours postoperatively; time to first analgesic request in hours calculated from the recovery of the patient until the first analgesic request (FLACC score ≥ 3); duration of analgesia in hours after awake extubation until the first analgesic request; total analgesic requirements, including fentanyl and diclofenac sodium suppository over the first 24 hours postoperatively; and the incidence of any side effects such as respiratory depression, urine retention, hematoma, nausea, vomiting, nerve injury, or infection.

Statistical Analysis

The collected information was tabulated and statistically analyzed using SPSS (Statistical Package for Social Sciences) software version 24.

Descriptive statistics were done for parametric quantitative data by mean, standard deviation and minimum and maximum of the range, and for nonparametric quantitative data by median and interquartile range, while they were done for categorical information by number and percentage.

Analyses were done for parametric quantitative data among the 3 groups using the one-way analysis of variance test followed by a post hoc Tukey correction between every 2 groups. For nonparametric quantitative data among the 3 groups we used Kruskal-Wallis test followed by Mann-Whitney U test between every 2 groups.

Analyses were done for parametric quantitative data within each group using a paired sample t-test, and for nonparametric quantitative data we used the Wilcoxon signed-rank test.

Tests were done for qualitative data using Fisher's exact test. The level of significance was held at ($P < 0.05$).

Sample Size Calculation

G*power program version 3.1.9, was used to calculate the sample size for this study, with a priory analysis. F-tests were used to detect the variance occurring in the duration of analgesia and FLACC score by multiple factors in 3 different groups. Based on previous studies (6-8) we assumed that these outcomes were largely affected thus having large variance. The effect size was calculated as 0.4 (large effect size), α error was 0.05, and power (1-β error) of 0.80 was used. The resulting sample size was 18 patients for each group. To compensate for dropouts and deviation from normal, a total of 63 patients were enrolled in this study.

Results

Figure 1 shows the Consolidated Standards of Reporting Trials (CONSORT) diagram of of this study's enrollment; 60 patients were included in the final analysis from 63 patients initially assessed for eligibility. Two patients were excluded from the study due to a technique failure, one in the ESB group and the other in the CB group. One patient was excluded in the C group due to bilateral surgery. The patients were randomly assigned into 3 parallel equal groups:

- Group ESB: The patient received an ultrasound-guided erector spinae muscle block in a dose of 0.4 mg/kg of 0.25% bupivacaine between the 10th transverse process and the erector spinae muscles.
- Group CB: The patient received an ultrasound-guided caudal block in a dose of 2.5 mg/kg of 0.25% bupivacaine.
- Group C: The patient did not receive any regional block.

Demographic Data

There were no statistically significant differences when comparing the 3 groups regarding mean age, gender distribution, mean weight, type of surgery, mean duration of surgery, and mean anesthetic time as shown in Table 2.

Intraoperative Analgesia

No patient in the 3 groups required additional intravenous fentanyl due to the short surgical time.

FLACC Score

On arrival at the postanesthesia care unit, the median interquartile range (IQR) of the FLACC score in the ESB group was 0 (0-0), the CB group was 0 (0-1), while in the C group it was 4.5 (2-6) that needed early rescue analgesia in the form of IV fentanyl one µg/kg.

The number of patients with FLACC scores of zero

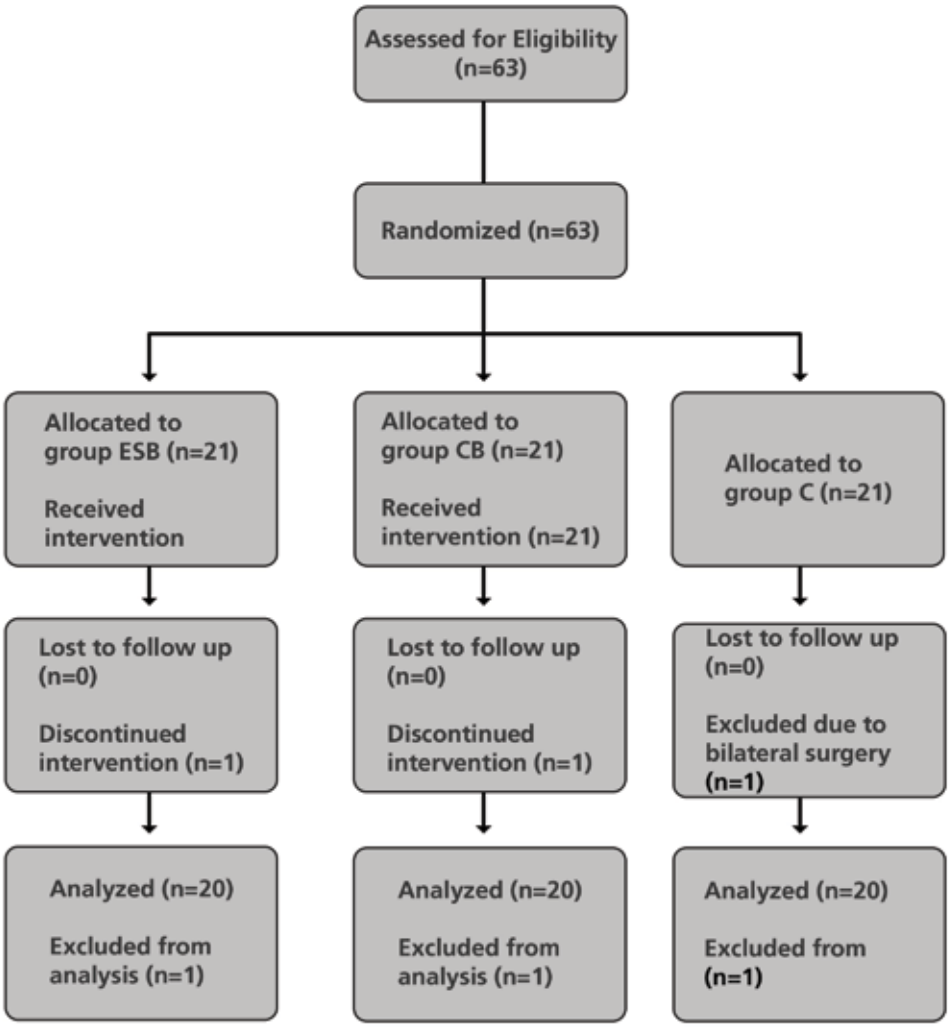

Fig. 1. *CONSORT diagram of the study.*

was 18, 11, and 0 in the ESB, CB, and C groups respectively, while the number of patients with FLACC scores > 3 were 0, 0, 14 in the 3 groups respectively.

In the ESB group, the median (IQR) of the FLACC score ranged from 0 (0-0) to 1 (0-1) during the first 6 postoperative hours, while at 8 and 12 hours postoperatively it was 1 (1-3) when the patients started to request analgesia. The number of patients with a FLACC score ≥ 3 were 9 and 11 at 8 and 12 hours postoperatively. Pain scores started to decrease during the following postoperative hours due to the supplementary analgesia.

In the CB group, the median (IQR) of the FLACC score ranged from 0 (0-1) to 1 (1-2) during the first 4 postoperative hours, while at 6 and 8 hours postoperatively it was 3 (1.5-4) and 2 (2-4) when almost all patients then received supplementary analgesia. The number of patients with a FLACC score ≥ 3 were 12 and 8 at 6 and 8 hours postoperatively. The pain score started to decrease during the remaining hours of the first postoperative day due to the requested analgesia.

In the C group, the median (IQR) of the FLACC score was high—4.5 (2-6) in the early minutes after recovery, where almost all the patients had a high FLACC score of more than 3, that needed immediate rescue analgesia in the form of IV fentanyl 1 μg/kg followed by a diclofenac suppository as needed. This controlled their postoperative pain during the first 24 hours.

When comparing the 3 groups with one another,

Table 2. *Demographic data in the studied groups*.

Variable	Group ESB (n = 20)	Group CB (n = 20)	Group C (n = 20)	*P* Value
Age (year) Mean ± SD	3.85 ± 1.53	3.58 ± 1.48	3.90 ± 1.59	0.772
Gender Boy Girl	 12 (60%) 8 (40%)	 10 (50%) 10 (50%)	 9 (45%) 11 (55%)	0.693
Weight (kg) Mean ± SD	19.05 ± 4.95	17.20 ± 5.72	18.35 ± 5.55	0.555
Type of surgery 1) Inguinal hernia 2) Hydrocele 3) Appendectomy	 10 (50%) 8 (40%) 2 (10%)	 8 (40%) 7 (35%) 5 (25%)	 10 (50%) 5 (25%) 5 (25%)	0.601
Anesthetic time (min) Mean ± SD	47.5 ± 5.4	48.7 ± 4.7	48.1 ± 5.7	0.754
Surgical time (min) Mean ± SD	28.3 ± 3.4	27.6 ± 4.5	28.7 ± 3.7	0.654

(data presented as mean ± SD or number and percentage).

we found that there was a significant difference observed during the first 24 hours postoperatively between both the ESB and CB groups with the C group. Also, there was a significant difference between the ESB group and the CB group. The ESB group showed a better FLACC score and a longer duration of analgesia than the CB group and both were more effective in controlling postoperative pain for a longer time than in the C group as shown in Table 3 and Fig. 2.

The Time to First Analgesic Request

When comparing the time of first analgesic request among the 3 groups in hours, we found that the median (IQR) of the duration of analgesia was 0.25 (0.17-4), 6 (6-8) ,and 8 (8-12) hours in groups C, CB, and ESB respectively as shown in Table 4 and Fig. 3.

Postoperative 24 hours Total Analgesic Requirement

Postoperative Fentanyl Requirement

No patient in either the CB or ESB groups required IV fentanyl in the first postoperative 24 hours as rescue analgesia but 14 patients in group C received IV fentanyl in a dose of 1 μg/kg and 6 patients required a diclofenac sodium suppository in a dose of 1 mg/kg.

Diclofenac Sodium) Requirements

When comparing the 3 groups, there was a significant decrease in the diclofenac sodium requirements in groups CB and ESB than in group C. When comparing the groups CB and ESB there was a significant decrease in group ESB than in group CB. Patients received 2-3 doses a diclofenac suppository in a dose of 1 mg/kg in group ESB, 3-4 doses of the same dosage in group CB, and all patients received 4 doses of the same dosage in group C as shown in Table 4.

Complications

The 3 groups were comparable regarding the incidence of postoperative complications. Two patients reported urinary retention in group CB. Nausea and vomiting were reported by 14 patients in group C), 16 in group ESB and 15 in C. No patients reported motor weakness, drowsiness, respiratory depression, hematoma, or infection at the site of injection as shown in Table 5.

Discussion

This prospective randomized double-blind controlled trial compared ultrasound-guided ESB with ultrasound-guided CB in pediatric patients regarding the efficacy and safety of the block. The results of our study confirmed the safety and efficacy of ESB and CB with a superior outcome for ESB.

We observed that the early postoperative FLACC score was lower in group ESB than CB; both were lower than the C group. The total amount of analgesia was lower in group ESB than group CB, but group C required higher analgesia. Also, there was a longer duration of pain relief in group ESB as the median (IQR) of the duration of analgesia was 8 (8-12) hours

Table 3. *FLACC score in the 3 studied groups.*

	Group ESB	Group CB	Group C	*P* Value
PACU Median (IQR)	ac 0 (0-0)	bc 0 (0-1)	4.5 (2-6)	< 0.001*
At one hour Median (IQR)	ac 0 (0-0)	bc 0.5 (0-1)	# 1 (1-1.5)	< 0.001*
At 2 hours Median (IQR)	ac 0 (0-0)	#bc 1 (1-1)	# 2 (1.5-4.5)	< 0.001*
At 3 hours Median (IQR)	ac 0 (0-0)	#bc 1 (1-1)	# 2 (2-2)	< 0.001*
At 4 hours Median (IQR)	#ac 0 (0-1)	#bc 1 (1-2)	4 (2-7)	< 0.001*
At 6 hours Median (IQR)	#ac 1 (0-1)	#bc 3 (1.5-4)	# 2 (2-2)	< 0.001*
At 8 hours Median (IQR)	#ac 1 (1-3)	#bc 2 (2-4)	3 (2-5)	0.001*
At 12 hours Median (IQR)	#a 1 (1-3)	# 2 (1-4)	2 (2-5.5)	0.013*
At 16 hours Median (IQR)	#a 3 (1.5-4)	#b 3 (1-5)	4 (3-5)	0.033*
At 20 hours Median (IQR)	#ac 1 (0-1)	#c 2 (1-2)	# 2 (2-2)	< 0.001*
At 24 hours Median (IQR)	#ac 4 (3.5-5)	#c 5 (4-5.5)	5.5 (4-6)	0.009*

(data presented with median interquartile range [IQR])
significant inside the group (Wilcoxon signed rank test)
P < 0.05 significant between the groups (Kruskal Wallis test)
a ESB vs C significant *P* < 0.05 (Mann Whitney test)
b CB vs C significant *P* < 0.05 (Mann Whitney test)
c ESB vs CB significant *P* < 0.05 (Mann Whitney test).

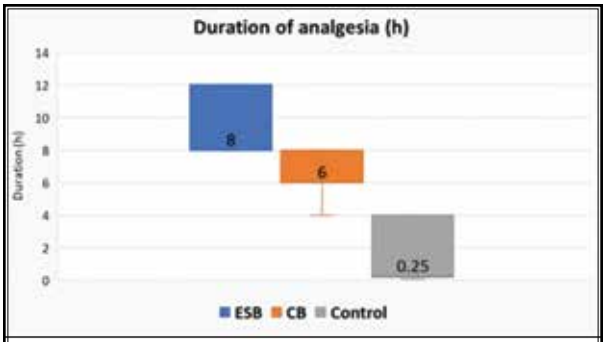

Fig. 2. *Box plot showing FLACC score among study group at each time point.*
Box-plots presents the following: interquartile range (Q1-Q3); x: median; bottom and top bars: observed minimum and maximum observed values; ○: outliers

in comparison with group CB that had a median (IQR) of the duration of analgesia of 6 (6-8) hours. Both of them had a longer duration of analgesia in comparison with group C which had a median (IQR) of the duration of analgesia of 0.25 (0.17-4) hours. The number of patients who needed rescue IV fentanyl analgesia was 14 patients in group C. No patient needed IV fentanyl in groups ESB and CB.

Our results in group ESB are in agreement with Mostafa et al (6) who reported lower pain scores in the group ESB in the first 8 postoperative hours as there were lower Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) scores in group ESB than their control group but at 12, 18, and 24 hours postoperatively, only minor and unimportant differences in the CHEOPS score were found between the 2 groups. Prolonged duration of analgesia was noticed in group ESB as the time to the first postoperative rescue analgesic requirement was longer compared to the control group. This may be explained by routinely administered analgesia in the form of a diclofenac suppository, 25 mg/8h to all patients; IV acetaminophen in the dose of 15mg/kg was administrated as rescue analgesia when the CHEOPS score was over 6 (6). Also the results of El-Emam and Abd El Motlb (7) agreed with us as they reported a lower FLACC score and prolonged first analgesic request in their group ESB than a group receiving an ilioinguinal nerve block (7).

On the other hand, several studies have reported a longer duration of analgesia than reported in our study due to a higher dose of local anesthetic used. Aksu and Gürkan (8) reported the use of ESB in 10 children aged 3-10 years in a dose of 0.5mL/kg of 0.25% bupivacaine who underwent bilateral inguinal hernia surgery. Only one patient with a FLACC score of 3 required rescue analgesia at the seventh postoperative hour in the form of IV acetaminophen 15 mg/kg. None of the other patients required any rescue analgesics for 24 hours postoperatively (8). The same authors in the same year (9) reported the use of ESB for postoperative analgesia in a dose of 0.5mL/kg of 0.25% bupivacaine in 2 patients, one aged 7 years and the other 6 months, who underwent nephrectomy. They reported a low CHEOPS score during the first 48 hours postoperatively and the children did not need any rescue analgesia (9). In a case report, Elkoundi et al (10) reported a FLACC score of one 24 hours postoperatively as they administered acetaminophen in a dose of 15 mg/kg/6h and on the second day of postoperatively a FLACC score of 3 was reported; nonsteroidal anti-inflammatory drugs were then administrated reducing the FLACC score to one again (10).

Karaca and Pinar (11) in 2019 reported the use of ESB in a dose of 2.5 mg/kg of bupivacaine 0.5% in 4 patients

Table 4. *Analgesic requirement (data presented as number and or mean ± SD), frequency of analgesia (data presented in number and percentage), duration of analgesia (data presented in median interquartile range [IQR]).*

Variable	Group ESB	Group CB	Group C	*P* Value		
Postoperative rescue fentanyl in µg				0.000*		
Range	0	0	0-15	ESB & C	CB & C	CB & ESB
Mean ± SD	0	0	5.35±4.38	< 0.001*	< 0.001*	1.000
Rescue frequency	0 (0%)	0 (0%)	14 (73.7%)	< 0.001*		
				ESB & C	CB & C	CB & ESB
				< 0.001*	< 0.001*	-
Diclofenac				0.000**		
Range	2-3	2-4	4	ESB & C	CB & C	CB & ESB
Mean ± SD	2.70±0.47	3.15±0.49	4	< 0.001*	< 0.001*	< 0.001*
Diclofenac frequency				ESB & C	CB & C	CB & ESB
2	6 (30.0%)	1 (5.0%)	0 (0.0%)			
3	14 (70.0%)	15 (75.0%)	0 (0.0%)	< 0.001*	< 0.001*	0.018*
4	0 (0.0%)	4 (20.0%)	20 (100.0%)			
Duration of analgesia (hr) Median (IQR)	8 (8-12)	6 (6-8)	0.25 (0.17-4)	< 0.001*		

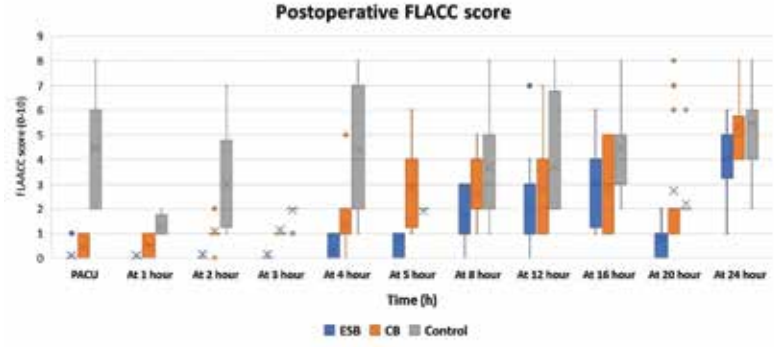

Fig. 3. *Duration of analgesia among the studied groups.*

Table 5. *Complications among the 3 studied groups.*

Variable	Group ESB	Group CB	Group C	*P* Value
Urinary retention Positive	0	2(10%)	0	0.032*
Nausea and vomiting Positive	16 (80%)	14 (70%)	15 (75%)	0.775

Data presented in number and percentage.
*comparison among the 3 groups by analysis of variance (ANOVA) test

aged 10, 11, 12, and 14 years undergoing laparoscopic cholecystectomy. They reported that these patients' Numeric Rating Scale (NRS-11)score was lower over 24 hours and there was no need for rescue analgesia. This may be explained by the high dose of bupivacaine used (11).

Also, in 2018 Thomas and Tulgar (12) reported the use of ESB in a dose of 15 mL of 0.25% bupivacaine in an 11-year-old patient who underwent laparoscopic cholecystectomy. They reported a low NRS-11 score and long-lasting postoperative analgesia as the NRS-11 score was lower than 3 during the first 24 hours postoperatively (12). In 2019 Balaban et al (13) reported the use of ESB in a case of a 6-year-old patient in a dose 20 mL of 0.25% bupivacaine who underwent neck femur fixation. The Wong-Baker Faces Pain Rating Scale cale was used to assess postoperative pain. They reported that the patient received analgesia only once at 12 hours postoperatively in the form of IV acetaminophen 250 mg. There was no need for opioid administration in the postoperative period. The pain scale was 0 during he first 12 hours postoperatively; after that it was 2 until the end of the twenty-fourth postoperative hour (13). This also may be explained by the high dose of local anesthetic used (13). In 2019 Öksüz et alreported a case of a 7-month-old child who received an ESB in a dose of one mL saline and 9 mL 0.25% bupivacaine who underwent anoplasty. They reported that the postoperative FLACC score was 0 over 24 hours and the patient did not need any postoperative analgesia (14).

Our results in group CB agreed with the study by Jahromi et al (15) in 2012 that compared acetaminophen suppository, wound infiltration by bupivacaine, and CB in patients aged 3 months to 7 years who underwent unilateral inguinal hernia repair. They reported no significant difference between bupivacaine infiltration and CB regarding duratioof analgesia (FLACC < 4). But they did report a significant difference between the 2 groups when compared with the acetaminophen group. Meperidine administration as a rescue analgesia was lower in the CB and bupivacaine infiltration groups than the acetaminophen group. A lower FLACC score was noticed in group CB than the acetaminophen group and there was an increase in the FLACC score during the first 2 hours postoperatively in the acetaminophen group that decreased after receiving meperidine (15). In 2015 Kanojia and Ahuja (16) compared transversus abdominis plane block and CB in children aged one-12 years who underwent lower abdominal surgery. They reported that the first analgesic request was ≤ 6 hours postoperatively in group CB (16). In 2012 Abdellatif (17) compared ilioinguinal/iliohypogastric nerve blocks to CB for postoperative analgesia in children aged one to 6 years who underwent unilateral surgery. He reported a delay in the first analgesic request and a longer duration of analgesia in the ilioinguinal/iliohypogastric nerve blocks group (17).

On the other hand, in 2012 Beyaz (18) reported a significant increase in CHEOPS score within each group that received either IV acetaminophen, CB, or combined CB and IV acetaminophen at 15 minutes postoperatively with no significance among the 3 groups. This may be because the CB technique was blind (18).

When comparing the total analgesic requirements between group ESB group and goup CB, group we found that children in group ESB received a diclofenac suppository 2-3 times in a dose of 1 mg/kg. In group CB, children received a diclofenac suppository 2-4 times while in group C all children received a diclofenac suppository 4 times.

In the study by Mostafa et al in 2019 (6), 28 out of 30 patients in his control group required postoperative acetaminophen compared to 13 out of 30 patients in the ESB group. In the control group, 3 patients required acetaminophen only once, 9 patients received 2 doses of paracetamol, 10 patients received 3 doses, and 6 patients received 4 doses. In the ESB group, 9 patients received acetaminophen once and 4 patients received 2 doses. The total postoperative consumption of acetaminophen was higher in the control group compared to the ESB group (6). Both Kanojia and Ahuja in 2015 (16) and El-Emam and Abd El motlb in 2019 (7) reported no significant difference between 2 groups regarding total analgesic requirements at 24 hours postoperatively and no complications were reported. In 2019 Aksu and Gürkan (8) reported no analgesic request over 24 hours postoperatively and no pain when they used ESB.

To our knowledge, our study may be the first one to compare ultrasound-guided ESB and ultrasound-guided CB in pediatric patients aged 2 to 6 years old.

There was no significant difference in the incidence of nausea and vomiting postoperatively among the 3 groups in our study. Two patients reported urine retention in group CB with no other block-related side effects such as hematoma, infection, respiratory depression, or motor weakness. This is in agreement with El-Emam and Abd El motlb (7) in 2019 as they reported no statistically significant difference regarding the incidence of postoperative vomiting (9 [30%] and 12 [40%] for IIN (Ilioinguinal block) and ESP (erector spinae block) groups, respectively). No motor weakness was reported in either group at 3 hours postoperatively (7). In 2019 Öksüz et al (14) 2019 reported no muscle weakness in the lower limbs and no other complication developed in their patients. In 2018 Hernandez et al (19)reported no complications and in 2012 Abdellatif (17) reported only one patient in their CB group and 2 patients in the ilioinguinal/iliohypogastric nerve blocks group had vomiting and received rescue antiemetic medications. This difference was not significant. None of the patients of either group had any motor weakness at 3 hours postoperatively (17).

Conclusions

Ultrasound-guided ESB was safe and effective and caused fewer side effects in pediatric patients who underwent unilateral lower abdominal surgery as it provided a longer duration of analgesia and fewer analgesic requirements than patients who received CB.

References

1. Willschke H, Kettner S. Pediatric regional anesthesia: Abdominal wall blocks. *Paediatr Anaesth* 2012; 22:88-92.
2. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain. *Reg Anesth Pain Med* 2016; 41:621–627.
3. Muñoz F, Cubillos J, Bonilla AJ, Chin KJ. Erector spinae plane block for postoperative analgesia in pediatric oncological thoracic surgery. *Can J Anaesth* 2017;64:880-882.
4. Abukawa Y, Hiroki K, Morioka N, et al. Ultrasound versus anatomical landmarks for caudal epidural anesthesia in pediatric patients. *BMC Anesthesiol* 2015; 15:102.
5. Crellin DJ, Harrison D, Santamaria N, Babl FE. Systematic review of the Face, Legs, Activity, Cry and Consolability scale for assessing pain in infants and children: Is it reliable, valid, and feasible for use? *Pain* 2015; 156:2132-2151.
6. Mostafa SF, Abdelghany MS, Abdelraheem TM, Abu Elyazed MM. Ultrasound-guided erector spinae plane block for postoperative analgesia in pediatric patients undergoing splenectomy: A prospective randomized controlled trial. *Paediatr Anaesth* 2019; 29:1201-1207.
7. El-Emam ES, Abd El motlb. Ultrasound-guided erector spinae versus ilioinguinal/iliohypogastric block for postoperative analgesia in children undergoing inguinal surgeries. *Anesth Essays Res* 2019; 13:274-279.
8. Aksu C, Gürkan Y. Opioid sparing effect of erector spinae plane block for pediatric bilateral inguinal hernia surgeries. J Clin Anesth 2018; 50:62-63.
9. Aksu C, Gürkan Y. Ultrasound guided erector spinae block for postoperative analgesia in pediatric nephrectomy surgeries. *J Clin Anesth* 2018; 45:35-36.
10. Elkoundi A, Bentalha A, El Kettani SE, Mosadik A, El Koraichi A. Erector spinae plane block for pediatric hip surgery-A case report. *Korean J Anesthesiol* 2019; 72:68.
11. Karaca Ö, Pinar HU. Efficacy of ultrasound-guided bilateral erector spinae plane block in pediatric laparoscopic cholecystectomy: Case series. *Agri* 2019; 31:209-213.
12. Thomas DT, Tulgar S. Ultrasound-guided erector spinae plane block in a child undergoing laparoscopic cholecystectomy. *Cureus* 2018;10:e2241.
13. Balaban O, Koçulu R, Aydın T. Ultrasound-guided lumbar erector spinae plane block for postoperative analgesia in femur fracture: A pediatric case report. *Cureus*. 2019;11:e5148.
14. Öksüz G, Arslan M, Bilal B, Gişi G, Yavuz C. Ultrasound guided sacral erector spinae block for postoperative analgesia in pediatric anoplasty surgeries. *J Clin Anesth* 2019; 60:88.
15. Jahromi SA. Effects of suppository acetaminophen, bupivacaine wound infiltration, and caudal block with bupivacaine on postoperative pain in pediatric inguinal herniorrhaphy. *Anesth Pain Med* 2012; 1(4):243-247.
16. Kanojia N, Ahuja S. Comparison of transversus abdominis plane block and caudal block for postoperative analgesia in children undergoing lower abdominal surgery. *Int J Sci Res* 2015; 4:1585-1587.
17. Abdellatif AA. Ultrasound-guided ilioinguinal/iliohypogastric nerve blocks versus caudal block for postoperative analgesia in children undergoing unilateral groin surgery. *Saudi J Anaesth* 2012; 6:367-372.
18. Beyaz SG. Comparison of preemptive intravenous paracetamol and caudal block in terms of analgesic and hemodynamic parameters in children. *J Clin Exp Invest* 2012; 3:202-208.
19. Hernandez MA, Palazzi L, Lapalma J, Cravero J. Erector spinae plane block for inguinal hernia repair in preterm infants. *Paediatr Anaesth* 2018; 28:298-299.